LESSON 7.1

Similar Polygons

Objectives

7.1 Similar Polygons
- a. I can define similar polygons.
- b. I can write similarity statements.
- c. I can determine the scale factor of two similar polygons.
- d. Given similar polygons, I can use proportions to write and solve equations.

Pick up a handout, protractor and piece of patty paper

LESSON 7.1

Similar Polygons

You know that figures that have the same shape and size are congruent figures. Figures that have the same shape but not necessarily the same size are **similar** figures. To say that two figures have the same shape but not necessarily the same size is not, however, a precise definition of similarity.

Is your reflection in a fun-house mirror similar to a regular photograph of you? The images have a lot of features in common, but they are not mathematically similar. In mathematics, you can think of similar shapes as dilations (enlargements or reductions) of each other with no irregular distortions.

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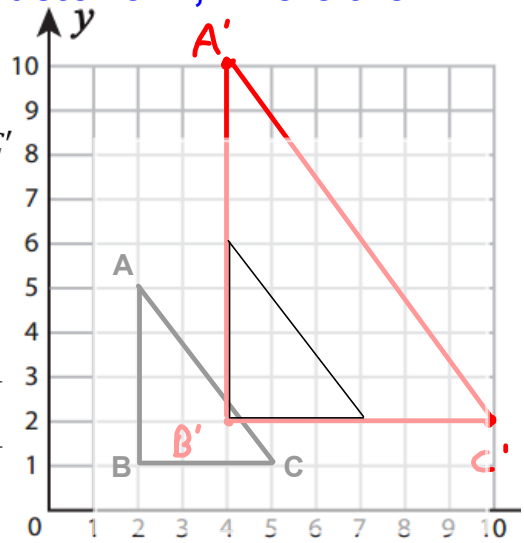
Warm-up: Dilate △ABC with a scale factor of 2, where the center of dilation is the origin (0, 0).



The dilation results in two similar triangles

$\Delta ABC \sim \Delta A'B'C'$ means ΔABC is similar to $\Delta A'B'C'$

Is this a reduction or enlargement? enlargement

$a^2+b^2=c^2$ $3^2+4^2=c^2$ $25=c^2$

Pre-image: AB 4 BC 3 CA 5

Image: A'B' 8 B'C' 6 C'A' 10

Ratio of corresponding side lengths

$\frac{A'B'}{AB} = \frac{8}{4} = 2$ $\frac{B'C'}{BC} = \frac{6}{3} = 2$ $\frac{C'A'}{CA} = \frac{10}{5} = 2$

$\frac{AB}{A'B'} = \frac{4}{8} = \frac{1}{2}$ $\frac{BC}{B'C'} = \frac{3}{6} = \frac{1}{2}$ $\frac{CA}{C'A'} = \frac{5}{10} = \frac{1}{2}$

$\Delta ABC \sim \Delta A'B'C'$

Now use patty paper to compare the corresponding angles.

How do the ratios of the corresponding sides compare?

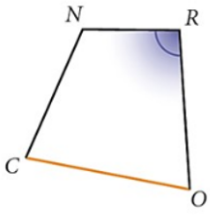
They are proportional.

How do the corresponding angles compare?

They are the same (congruent)

Two Polygons are Similar if and only if all ratios of corresponding sides are proportional and all pairs of corresponding angles are congruent

The statement CORN~PEAS says that quadrilateral CORN is similar to quadrilateral PEAS. The order of letters tells you which segments and which angles in the two polygons correspond.



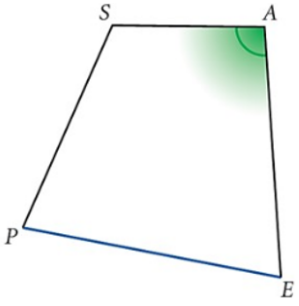
Corresponding angles are congruent:

$\angle C \cong \angle P$ $\angle R \cong \angle A$

$\angle O \cong \angle E$ $\angle N \cong \angle S$

Corresponding segments are proportional:

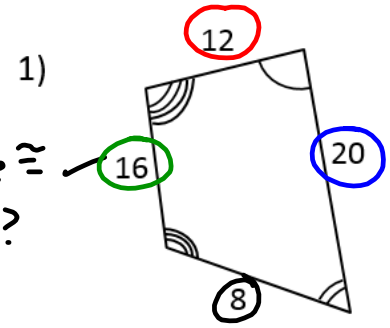
$\frac{CO}{PE} = \frac{OR}{EA} = \frac{RN}{AS} = \frac{NC}{SP}$

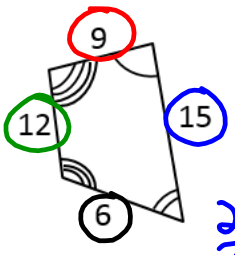


~ "Similar to"

Are the polygons below similar? Explain why or why not.

1)





Angles are ≅

Sides prop.?

$\frac{20}{15} = \frac{4}{3}$

$\frac{16}{12} = \frac{4}{3}$

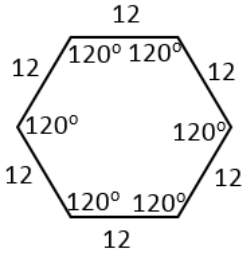
$\frac{12}{9} = \frac{4}{3}$

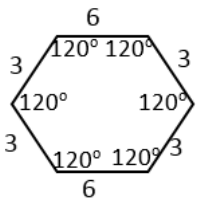
Similar / Not Similar (circle one)

Reason: Corr. ∠s are ≅ and corr. sides are prop. $\frac{8}{6} = \frac{4}{3}$

Are the polygons below similar? Explain why or why not.

2)





$\frac{12}{6} = 2$

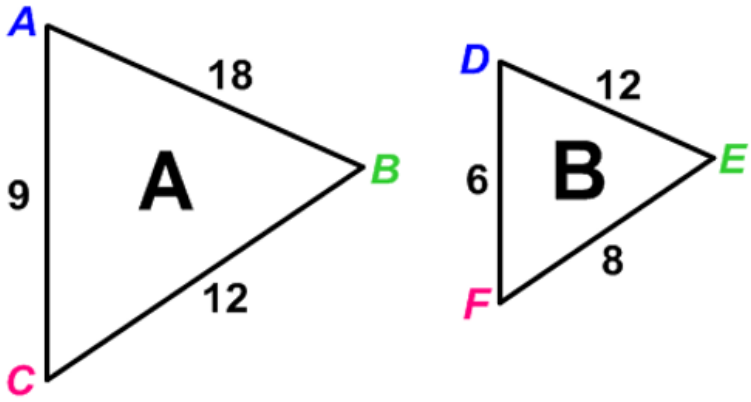
$\frac{12}{3} = 4$

Similar / Not Similar (circle one)

Reason: Sides not proportional

The following polygons are similar. Write a similarity statement and find the scale factor of figure *A* to figure *B*.

3)



$\frac{18}{12} = \frac{3}{2}$

$\frac{12}{8} = \frac{3}{2}$

$\frac{9}{6} = \frac{3}{2}$

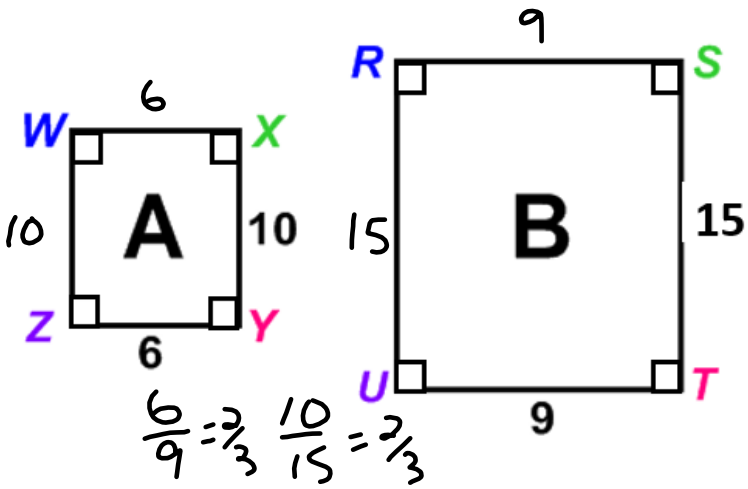
Similarity Statement: $\triangle ABC \sim \triangle DEF$

Scale factor of figure A to figure B: $\frac{2}{3}$

Reduction / Enlargement? (Circle one)

The following polygons are similar. Write a similarity statement and find the scale factor of figure *A* to figure *B*.

4)



$\frac{15}{10} = \frac{3}{2}$

$\frac{9}{6} = \frac{3}{2}$

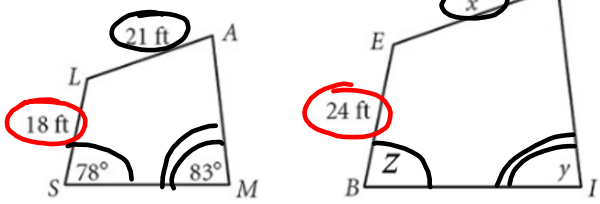
$\frac{6}{9} = \frac{2}{3}$ $\frac{10}{15} = \frac{2}{3}$

Similarity Statement: $WXYZ \sim RSTU$

Scale factor of figure A to figure B: $\frac{3}{2}$ Greater than 1

Reduction / Enlargement? (Circle one)

5) In the diagram, SMAL~BIGE.



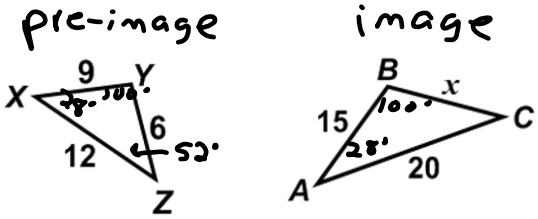
x = 28
y = 83°
z = 78°

$\frac{18}{24} = \frac{21}{x}$

$18x = 504$

$x = 28$

6) In the diagram $\Delta XYZ \sim \Delta ABC$.



Scale factor of ΔXYZ to ΔABC : $\frac{5}{3}$

Reduction / Enlargement? (Circle one)

x = 10

If $m\angle A = 28°$ and $m\angle B = 100°$, what is $m\angle Z$?

52°

$\frac{XY}{AB} = \frac{9}{15} = \frac{3}{5}$

$\frac{6}{x} = \frac{9}{15}$

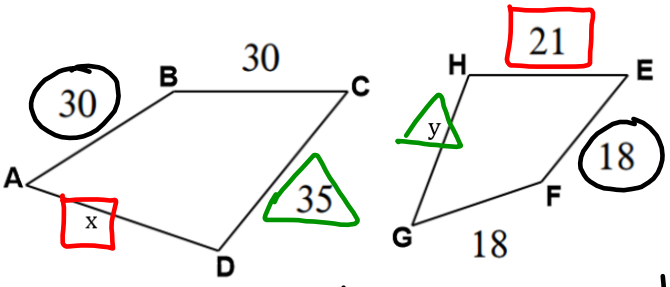
$\frac{YZ}{BC} = \frac{6}{x}$

$9x = 90$

$x = 10$

$\frac{XZ}{AC} = \frac{12}{20}$

7) In the diagram, $ABCD \sim EFGH$.



Scale factor of $ABCD$ to $EFGH$: $\frac{3}{5}$

Reduction / Enlargement? (circle one)

x = 35

y = 21

$\frac{18}{30} = \frac{3}{5}$

$\frac{18}{30} = \frac{21}{x}$

$18x = 630$

$x = 35$

$\frac{18}{30} = \frac{y}{35}$

$30y = 630$

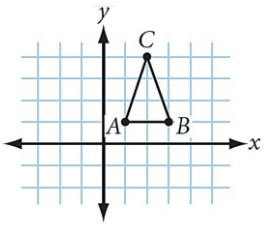
$y = 21$

Homework: 7.1 Similar Polygons Homework

LESSON 7.1

Similar Polygons

Extra Example



Copy ΔABC. Draw its dilation by a scale factor of 2.

What is the center of the dilation?

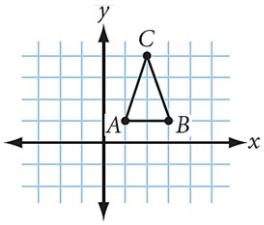
What is the ratio of the sides of the triangle and its image?

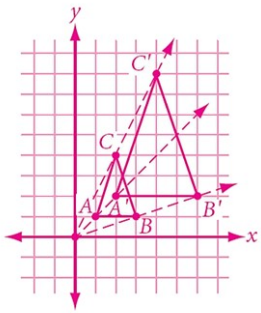
LESSON 7.1

Similar Polygons

Extra Example

ANSWER





Copy ΔABC. Draw its dilation by a scale factor of 2.

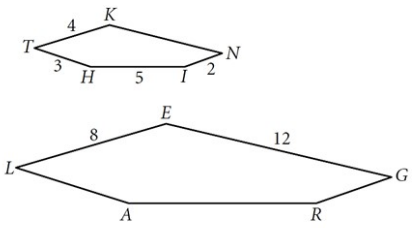
What is the center of the dilation? (0, 0)

What is the ratio of the sides of the triangle and its image? 1:2

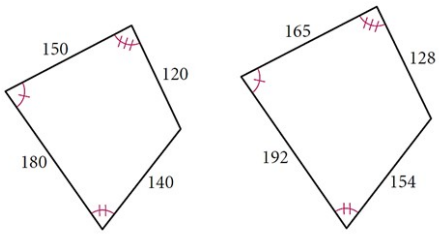
7.1 Exercises
pages 378 – 381

For Exercises 11–18, use the definition of similar polygons. All measurements are in centimeters.

11. *THINK ~ LARGE*
Find *AL*, *RA*, *RG*, and *KN*.

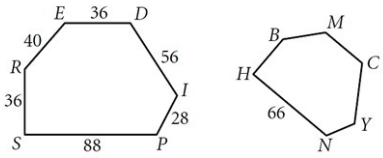


12. Are these polygons similar?
Explain why or why not. (h)

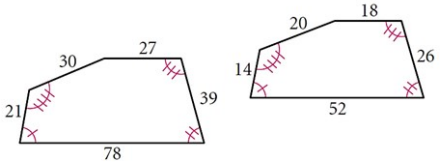


7.1 Exercises
pages 378 – 381

13. *SPIDER ~ HNYCMB*
Find *NY*, *YC*, *CM*, and *MB*.



14. Are these polygons similar?
Explain why or why not.



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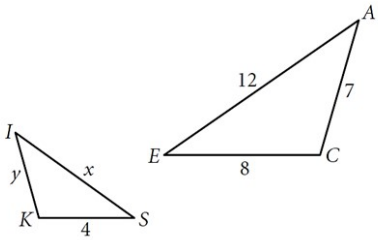
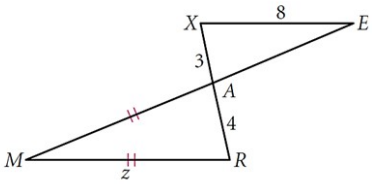
Lesson 7.1: Similar Polygons

7.1 Exercises
pages 378 – 381

15. $\triangle ACE \sim \triangle IKS$
Find x and y.

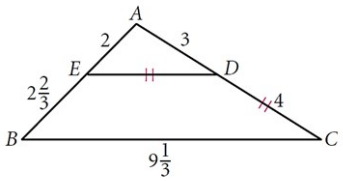


16. $\triangle RAM \sim \triangle XAE$
Find z.

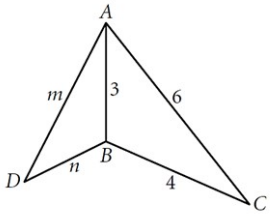


7.1 Exercises
pages 378 – 381

17. $\overline{DE} \parallel \overline{BC}$
Are the corresponding angles congruent in $\triangle AED$ and $\triangle ABC$? Are the corresponding sides proportional? Is $\triangle AED \sim \triangle ABC$? Explain your reasoning. (h)



18. $\triangle ABC \sim \triangle DBA$
Find m and n.



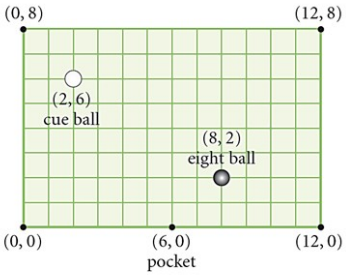
7.1 Exercises
pages 378 – 381

23. Use a compass and straightedge to construct

a. A rhombus with a 60° angle.

b. A second rhombus of different size with a 60° angle.

24. An 8×12 pool table has been "coordinatized" as shown to the right. If the cue ball is at (2, 6) and the eight ball is at (8, 2), what are the coordinates of the point on the top cushion that the ball must hit so that it bounces off the cushion and strikes the eight ball?

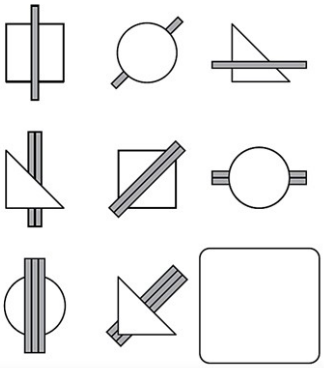


7.1 Exercises
pages 378 – 381

DEVELOPING MATHEMATICAL REASONING

3-by-3 Inductive Reasoning Puzzle II

Sketch the figure missing in the lower right corner of this pattern.

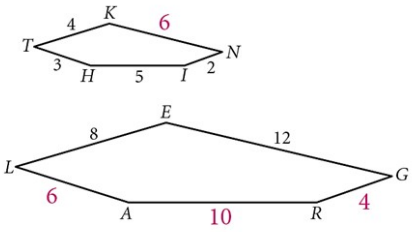


ANSWERS

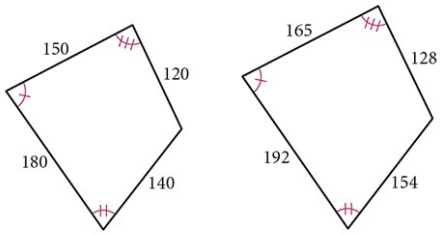
7.1 Exercises

For Exercises 11–18, use the definition of similar polygons. All measurements are in centimeters.

11. *THINK ~ LARGE*
Find *AL*, *RA*, *RG*, and *KN*.



12. Are these polygons similar?
Explain why or why not. (h)

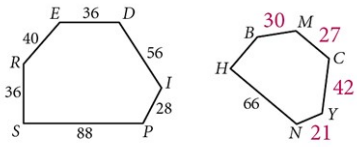


No; the corresponding angles are congruent, but the corresponding sides are not proportional.

ANSWERS

7.1 Exercises

13. *SPIDER ~ HNYCMB*
Find *NY*, *YC*, *CM*, and *MB*.



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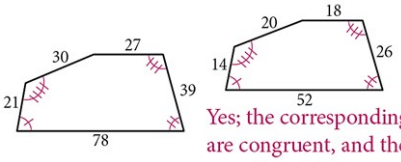
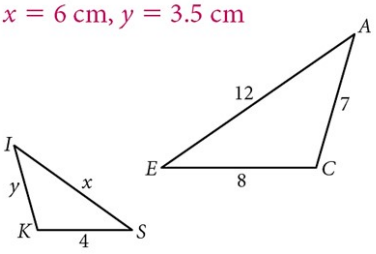


Yes; the corresponding angles are congruent, and the corresponding sides are proportional.

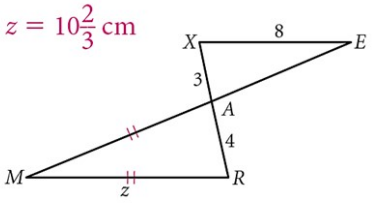
ANSWERS

7.1 Exercises

15. $\triangle ACE \sim \triangle IKS$
Find x and y.
$x = 6$ cm, $y = 3.5$ cm



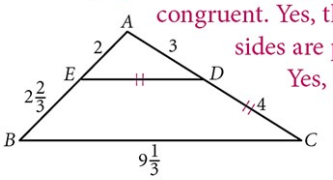
16. $\triangle RAM \sim \triangle XAE$
Find z.
$z = 10\frac{2}{3}$ cm



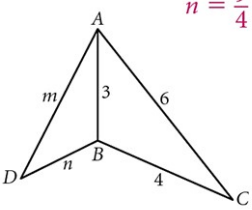
ANSWERS

7.1 Exercises

17. $\overline{DE} \parallel \overline{BC}$
Are the corresponding angles congruent in $\triangle AED$ and $\triangle ABC$? Are the corresponding sides proportional? Is $\triangle AED \sim \triangle ABC$? Explain your reasoning. (h) Yes, the corresponding angles are congruent. Yes, the corresponding sides are proportional. Yes, $\triangle AED \sim \triangle ABC$.



18. $\triangle ABC \sim \triangle DBA$
Find m and n.
$m = \frac{9}{2}$ cm $= 4.5$ cm;
$n = \frac{9}{4}$ cm $= 2.25$ cm



ANSWERS

7.1 Exercises

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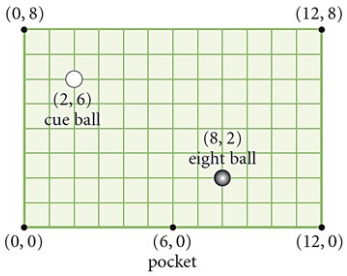
(3.5, 8)



ANSWERS

7.1 Exercises

DEVELOPING MATHEMATICAL REASONING

3-by-3 Inductive Reasoning Puzzle II

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